

What is claimed is:

1. An apparatus for evaluating a deteriorated state of a hydrocarbon adsorbent disposed in an exhaust passage of an internal combustion engine for adsorbing hydrocarbons contained in an exhaust gas emitted from the internal combustion engine, based on the transition characteristics of an output signal of a humidity sensor which is disposed in the exhaust passage downstream of said hydrocarbon adsorbent after the internal combustion engine has started to operate, said apparatus comprising:

changing timing detecting means for detecting a changing timing at which a humidity represented by the output signal of the humidity sensor changes to a tendency to monotonously increase from a low humidity to a high humidity based on a comparison between a characteristic quantity of a change in the output signal of the humidity sensor and a preset value, after the internal combustion engine has started to operate;

evaluating parameter acquiring means for acquiring data representing a total amount of moisture carried by the exhaust gas to said hydrocarbon adsorbent up to said changing timing after the internal combustion engine has started to operate, as a deterioration evaluating parameter for evaluating the deteriorated state of the hydrocarbon adsorbent;

characteristic change detecting means for detecting a characteristic change of said humidity sensor based on the output signal of the humidity sensor under a predetermined condition; and

characteristic change compensating means for correcting said preset value to detect said changing timing based on the characteristic change detected by said characteristic change detecting means.

2. An apparatus according to claim 1, wherein said changing timing detecting means comprises means for sequentially retrieving states in which the humidity represented by the output signal of said humidity sensor takes a minimum value, after the internal combustion engine has started to operate, and detecting said changing timing when a change in the output signal of said humidity sensor from the latest minimum value in the retrieved states to the high humidity, serving as said characteristic quantity, exceeds said preset value.

3. An apparatus according to claim 1, wherein said characteristic change detecting means comprises means for determining a change, from a predetermined reference value, of the output signal of said humidity sensor which is of a substantially constant high humidity level, as characteristic change detecting data represen-

tative of the characteristic change of said humidity sensor, after said changing timing is detected by said changing timing detecting means, and detecting the characteristic change of said humidity sensor based on said characteristic change detecting data.

4. An apparatus according to claim 1, further comprising characteristic data holding means associated with said humidity sensor, for holding, in advance, data with respect to characteristics of each individual unit of said humidity sensor, and said characteristic change detecting means comprises means for detecting the characteristic change of said humidity sensor based on the output signal of the humidity sensor under said predetermined condition and the data held by said characteristic data holding means.

5. An apparatus according to claim 3, further comprising characteristic data holding means associated with said humidity sensor, for holding, in advance, data for identifying said reference value with respect to said characteristic change detecting data as data with respect to characteristics of each individual unit of said humidity sensor, and said characteristic change detecting means comprises means for determining said characteristic change detecting data using said reference value which is

identified by the data held by said characteristic data holding means.

6. An apparatus according to claim 4 or 5, wherein said characteristic data holding means comprises a resistive element having a resistance depending on the data with respect to characteristics of each individual unit of said humidity sensor.

7. An apparatus according to claim 1, wherein said evaluating parameter acquiring means comprises means for generating integrated moisture quantity data representative of sequentially integrated data of a quantity of moisture contained in said exhaust gas emitted from said internal combustion engine from the start of operation of said internal combustion engine, and means for acquiring said integrated moisture quantity data at said changing timing as said deterioration evaluating parameter.

8. An apparatus for evaluating a deteriorated state of a hydrocarbon adsorbent disposed in an exhaust passage of an internal combustion engine for adsorbing hydrocarbons contained in an exhaust gas emitted from the internal combustion engine, based on the transition characteristics of output signals of upstream and downstream

humidity sensors which are disposed in the exhaust passage respectively upstream and downstream of said hydrocarbon adsorbent after the internal combustion engine has started to operate, said apparatus comprising:

upstream changing timing detecting means for detecting a changing timing at which a humidity represented by the output signal of the upstream humidity sensor changes to a tendency to monotonously increase from a low humidity to a high humidity based on a comparison between a characteristic quantity of a change in the output signal of the upstream humidity sensor and a first preset value, after the internal combustion engine has started to operate;

downstream changing timing detecting means for detecting a changing timing at which a humidity represented by the output signal of the downstream humidity sensor changes to a tendency to monotonously increase from a low humidity to a high humidity based on a comparison between a characteristic quantity of a change in the output signal of the downstream humidity sensor and a second preset value;

evaluating parameter acquiring means for acquiring data representing a total amount of moisture carried by the exhaust gas to said hydrocarbon adsorbent from said upstream changing timing to said downstream changing timing, as a deterioration evaluating parameter

for evaluating the deteriorated state of the hydrocarbon adsorbent;

characteristic change detecting means for detecting a characteristic change of each of said humidity sensors based on the output signals of the humidity sensors under a predetermined condition; and

characteristic change compensating means for correcting said first preset value and said second preset value based on the characteristic changes of said upstream humidity sensor and said downstream humidity sensor detected by said characteristic change detecting means.

9. An apparatus according to claim 8, wherein said upstream changing timing detecting means comprises means for sequentially retrieving states in which the humidity represented by the output signal of said upstream humidity sensor takes a minimum value, after the internal combustion engine has started to operate, and detecting said changing timing with respect to said upstream humidity sensor when a change in the output signal of said upstream humidity sensor from the latest minimum value in the retrieved states to the high humidity, serving as said characteristic quantity with respect to said upstream humidity sensor, exceeds said first preset value, and said downstream changing timing detecting means com-

prises means for sequentially retrieving states in which the humidity represented by the output signal of said downstream humidity sensor takes a minimum value, after the internal combustion engine has started to operate, and detecting said changing timing with respect to said downstream humidity sensor when a change in the output signal of said downstream humidity sensor from the latest minimum value in the retrieved states to the high humidity, serving as said characteristic quantity with respect to said downstream humidity sensor, exceeds said second preset value.

10. An apparatus according to claim 8, wherein said characteristic change detecting means comprises means for determining a change, from a predetermined reference value, of the output signal of said upstream humidity sensor which is of a substantially constant high humidity level, as characteristic change detecting data representative of the characteristic change of said upstream humidity sensor, after said changing timing is detected by said upstream changing timing detecting means, determining a change, from a predetermined reference value, of the output signal of said downstream humidity sensor which is of a substantially constant high humidity level, as characteristic change detecting data representative of the characteristic change of said downstream

humidity sensor, after said changing timing is detected by said downstream changing timing detecting means, and detecting the characteristic change of each of said humidity sensors based on said characteristic change detecting data with respect to each of said humidity sensors.

11. An apparatus according to claim 8, further comprising characteristic data holding means associated respectively with said upstream and downstream humidity sensors, for holding, in advance, data with respect to characteristics of each individual unit of said upstream and downstream humidity sensors, and said characteristic change detecting means comprises means for detecting the characteristic changes of upstream and downstream humidity sensors based on the output signals of the upstream and downstream humidity sensors under said predetermined condition and the data held by said characteristic data holding means.

12. An apparatus according to claim 10, further comprising characteristic data holding means associated respectively with said humidity sensors, for holding, in advance, data for identifying said reference values with respect to said characteristic change detecting data with respect to the respective humidity sensors as



data with respect to characteristics of each individual unit of said humidity sensors, and said characteristic change detecting means comprises means for determining said characteristic change detecting data with respect to the respective humidity sensors using said reference values which are identified by the data held by said characteristic data holding means of the respective humidity sensors.

13. An apparatus according to claim 11 or 12, wherein said characteristic data holding means comprise respective resistive elements having respective resistances depending on the data with respect to characteristics of individual units of said humidity sensors.

14. An apparatus according to claim 8, wherein said evaluating parameter acquiring means comprises means for generating integrated moisture quantity data representative of sequentially integrated data of a quantity of moisture contained in said exhaust gas emitted from said internal combustion engine from the start of operation of said internal combustion engine, and means for acquiring the difference between the integrated moisture quantity data at said changing timing with respect to said downstream humidity sensor and the integrated moisture quantity data at said changing timing with respect

to said upstream humidity sensor, as said deterioration  
evaluating parameter.